ECE482 — Introduction to Operating Systems

Homework 8

Manuel — JI (Fall 2024)

ECE4820 Exercises

Ex. 1 — *Input/Output*

1. Is it possible to scan a document and send it through a wireless network at full speed? Explain why, why not.

2. How can an OS facilitate the installation of a new device without any need to recompile the OS or even to reboot it?

3. In the slides four I/O software layers are listed; in which layers are the following operations done:

    a) Computing the track, sector, and head for a disk read

    b) Writing command to the device registers

    c) Checking if the user is allowed to use the device

    d) Converting binary integers to ASCII for printing

4. A DMA controller has four channels. The controller is able to request a 32bit word every 100 nsec. A respond takes equally long. How fats should the bus be in order to avoid being a bottleneck?

5. Briefly explain what a thin client is.

6. Describe how a hard disk is working and give a few details regarding its geometry.

7. What are differences between RAID 0, 1, 5, 6, and 10?

Ex. 2 — *Multiprocessors*

1. Suppose that the `TSL` instruction was not available for synchronizing a multiprocessor. Instead, another instruction, `SWP` was provided that atomically swapped the contents of a register with a word in memory. How could that be used to provide multiprocessor synchronisation?

2. Briefly describe virtualization and the main challenges that need to be overcome.

Ex. 3 — *File systems*

1. Assuming the current working directory is `/usr/share/doc/mutt/examples` what is the absolute path of `../../../doc/../../lib/mutt`?

2. A Unix system has 1KB blocks and 4B disk addresses. What is the maximum file size if i-nodes contain 13 direct entries, and one single, double , and triple indirect entry each?

3. The time required to read a certain number of bytes can be approximated by summing the seek, rotation delay, and transfer times. Given a disk with mean seek time of 8 msec, a rotation rate

of 15,000 rpm and 262,144 bytes per track what are the data rates for block sizes of (i) 1 KB, (ii) 2 KB, and (iii) 4 KB?

Ex. 4 — *Security*

1. If using only lowercase letters how many possible 8 letter words can be chosen? Explain why a password should always contain lower and uppercase letters, numbers and symbols.

2. Explain why memory dynamically allocated using `malloc` is sometimes random and some other times set to 0.

3. A computer system is made of several components each featuring a different level of security. How secure is this system?

4. Can security be achieved? Explain your answer.

Ex. 5 — *Research*

Write about half a page on the topic of firewalls on Linux systems; include information on `iptables`. Do not forget to reference your sources of information.

ECE4821 Exercise

Ex. 6 — *Research*

1. Write about half a page on the topic of firewalls on Linux systems; `ebtables` and `arptables`. Do not forget to reference your sources of information.

2. As Linux is migrating from `iptables` to `nftables`, briefly present the latter one and explains it benefits over the former one.